Tenneco Minerals
A Tenneco Company

P.O. Box 2650
St. George, Utah 84770

May 20, 1991

Lyle Stott
Engineer
Utah Bureau of Water Pollution Control
288 North 1460 West
Salt Lake City, Utah 84116-0690

RE: Report on Results of Drainage System Investigation, Tenneco Minerals Goldstrike Mine.

Dear Mr. Stott:

A study was conducted by JBR Consultants Group to determine the adequacy of the present storm drainage system at the Tenneco Goldstrike Mine. Drainage areas for the site were determined using topographic maps supplied by Tenneco showing the present configuration of the mine site. Runoff volumes were determined for the 100-year, 24-hour rainfall events for each drainage area. These volumes were then each routed through the present ditches and culverts.

Methodology

Runoff control structures were evaluated to upgrade from the 10-year, 24 hour precipitation event (2.3 inches) to the 100-year, 24-hour precipitation event of 3.4 inches. These precipitation values were obtained from the Hydrologic Atlas for Utah (Miller et al., 1973). An SCS Type II storm distribution was used for all hydrograph generations. The SCS Curve Number/Unit Hydrograph method (SCS, 1972) was used to calculate runoff volumes and peak flows. Curve Numbers were derived using the tables in Van Haveren (1986). A computer program (Hawkins and Marshall, 1980) was used to generate the hydrographs. Drawing No. 1 shows the boundaries of the drainage basins, and Table 1 provides some of the drainage basin characteristics.

The ditches were sized using hydraulic software (Barfield et al., 1983). Culverts were sized using engineering methods as outlined in AISI(1983) and Barfield et al.(1983).

The ditches and culverts which the drainage areas are routed through are shown on Drawing No. 1 and the flow for the 100-year precipitation event is listed in Table 2. The ditches are triangular in cross section with the exception of ditch F which is a trapezoid. The ditches are constructed of natural materials

adjacent to the roadway. The culverts are made of corrugated metal pipe (CMP).

Plan of Action

Although existing stormwater diversion ditches that are not intended to remain following mine closure were permitted through the Utah division of Oil, Gas and Mining, and the Bureau and constructed to withstand the 10-year storm event, Tenneco Minerals plans to take a more conservative approach and size these ditches to withstand runoff from a 100-year, 24-hour storm event. The size specifications for all ditches to withstand the 100-year, 24-hour precipitation event are in Table 3. Design depths are rounded up to ensure adequate freeboard in the ditches. Widths are designed to give approximately the same side slope currently in place in the ditches. For calculating widths, measurements were rounded up to the nearest half-foot for values below 5 feet wide and to the nearest foot for widths greater than 5 feet.

Tenneco also plans to use the culvert specifications for the 100-year runoff as listed in Table 4. All culverts are designed to be 16 gauge CMP with pitch x depth of 2⅔" x ½". There should be 4 feet of cover between the top of the culverts and the surface of the roads which cover them. Tenneco Minerals plans to have the revisions to the ditches and culverts done by July 31, 1991.

Please call me if you have any questions concerning this matter.

Sincerely,

Ken Kluksdahl by Edith W. Lips

Ken Kluksdahl
Mine Manager

enc.

cc: D. Brannum, Tenneco Minerals Company
cc: K. Leachman, JBR Consultants Group
cc: E. Lips, JBR Consultants Group

References

American Iron and Steel Institute, 1983, Handbook of Steel Drainage & Highway Construction Products: American Iron and Steel Institute, Washington, D.C., 414 p.

Barfield, B.J., Warner, R.C., and Haan, C.T., 1983, Applied hydrology and sedimentology for disturbed areas: Oklahoma Technical Press, Stillwater, Oklahoma, 603 p.

Hawkins and Marshall, 1980,Storm Hydrograph Program Final Report to the Utah Division of Oil, Gas and Mining: Utah State University Foundation, Logan, Utah.

Miller, J.F. et al, 1973, Precipitation-Frequency Atlas of the Western United States: Volume VI-Utah, NOAA Atlas 2, National Oceanic and Atmospheric Administration, National Weather Service, Silver Springs, Maryland.

Soil Conservation Service, 1972, National Engineering Handbook NEH-4 Hydrology, Washington, D.C.

Van Havren, Bruce P., 1986, Water Resource Measurements: A Handbook for Hydrologists and Engineers, American Water Works Association.

Table 1 Drainage Basin Characteristics

Drainage ID	Area (ac)	Curve Number	Time Conc. (hrs)	10-yr, 24 hr peak flow (cfs)	100-yr, 24 hr peak flow (cfs)
A	72	85	0.05	80	143
A′	23	70	0.12	8.3	23
B	8	77	0.06	5.6	8.5
B′	11	80	0.03	9.1	18
C	33	70	0.13	12	32.4
D	34	70	0.16	11	32
E	560	70	0.38	128	408
F	2.9	90	0.08	3.9	6.5
F′	1.7	90	0.02	2.35	3.8
G	1.9	80	0.06	1.6	3.1
H	3.8	80	0.05	3.2	6.3
I	7.0	90	0.10	9.4	16
I′	4.5	90	0.07	6.1	10
I′′	2.5	90	0.04	3.4	5.7
J	9.6	88	0.03	12	21
K	1.0	85	0.04	1.1	2.0
L	6.4	90	0.07	8.7	14
L′	1.6	90	0.05	2.2	3.7
L′′	1.0	90	0.04	1.4	2.2
L′′′	0.2	90	0.03	0.3	0.5
M	12	85	0.03	14	25
N	28	88	0.05	35	60
P	1.0	79	0.02	0.8	1.6

Table 2 Flow depths in ditches for 100-year runoff

Ditch	Drainage areas flowing into ditch	Ditches flowing into ditch	Flow depth (ft.)
A	B	N/A	0.87
B	B′	N/A	1.16
C	G	N/A	0.67
D	A′,F′	N/A	1.73
E	F,I′	N/A	1.19
F	C	N/A	1.99
G′	I′′	D,B	1.69
G	L′′′,I	J,G′	1.74
H	L	G,E	2.28
I	H,J	N/A	1.31
J	K,L′′	N/A	0.67
K	N,P	N/A	2.29

Table 3 Specifications for all ditches to withstand runoff from 100-year precipitation event

Ditch ID	Depth (ft)	Width (ft)	Shape
A	1.5	4	V
B	1.5	4	V
C	1	3	V
D	2	6	V
E	1.5	4	V
F	2.5	6	Trapezoid
G′	2	6	V
G	2	6	V
H	2.5	7	V
I	1.5	4.5	V
J	1	3	V
K	2.5	7	V

Table 4 Culvert** specifications for 100-year runoff

Culvert	Adjacent Ditches	Pipe dia. (in.)	100-yr Flow (cfs)	Length (ft.)	Slope (%)	100-yr Headwater (ft.)
1	H	42	102	120	2	8.0
2	K	36	62	64	1	6.5
3	B,D	30	48	100	2	6.5
4	E	24	17	44	1	2.5

** All culverts are designed to be 16 gauge CMP with a pitch x depth of 2⅔" x ½". There should be 4 feet of cover between the top of the culverts and the surface of the roads which cover them.